Summer 2004

RPM News

▲ Remedial Project Manager News ▲

"Communicating Navy Installation Restoration Program News and Information Among All Participants"

In This Issue

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Fall 2004	***6 August***
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RPM NEWS

Remedial Project Manager News

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Strategies for Addressing DCE Stall at Chlorinated Solvent Impacted Sites

Over the past decade, the fate and transport of chlorinated solvent compounds in groundwater has been an issue of great interest to the scientific community, regulators, and other environmental stakeholders. Scientific understanding of the complex biodegradation mechanisms for these compounds has evolved over time and there has been a trend towards the increased use of monitored natural attenuation (MNA) and active biological treatment technologies for the remediation of chlorinated solvent impacted sites. The reductive dechlorination of perchloroethene (PCE) and trichloroethene (TCE) to dichlorethene (DCE) appears to be universal at sites under at least sulfate-reducing conditions. However, at some sites, the biodegradation process stalls at DCE because the necessary conditions are not present for efficient and complete dechlorination of PCE to TCE to ethene and ethane. When the reductive dechlorination process is incomplete, the levels of DCE in groundwater can build up over time. This phenomenon is referred to as "DCE stall" and it can limit the ability to meet cleanup goals and obtain site closure within a reasonable timeframe. This article discusses the suspected causes of DCE stall, along with potential solution strategies for this problem.

In a recent survey of environmental remediation professionals, approximately 25% of respondents indicated that DCE stall was an issue at their chlorinated solvent impacted sites (McGuire et al., 2003). The condition of DCE stall may occur at these sites for several reasons, but there are two basic requirements for establishing a complete reductive dechlorination pathway including:

- Sufficient electron donors to achieve strongly reducing conditions
- Bacteria capable of efficient dechlorination of DCE to ethene

If these conditions are not met at a site, DCE stall will likely be observed. However, it should be noted that biological activity can be hindered at some sites by extreme conditions that are not related to the above requirements, including extreme pH, presence of biotoxins, micronutrient limitations, and other factors.

The first potential reason for DCE stall is a lack of sufficient electron donors to achieve the necessary strongly reducing conditions. When the supply of electron donors is very limited and oxygen is still present, aerobic organisms will be the most active because they derive the most energy under these conditions. When electron donors are in sufficient supply for microbes to deplete naturally occurring electron acceptors down to sulfate, organisms that reduce PCE and TCE can finally derive enough energy to compete and will become active. Under these strongly reducing conditions, chlorinated organics will also be used as electron acceptors. Chlorine atoms on the chlorinated organics are sequentially replaced with hydrogen atoms from an electron donor. This process is known as "reductive dechlorination" and is illustrated in Figure 1. Due to the low energy available from the reduction of DCE and vinyl chloride (VC), microorganisms can generally only carry out this process when sufficient electron donors are present to create methanogenic conditions.

The second possible reason for DCE stall is that no bacteria is present at the site that are capable of efficiently dechlorinating DCE to ethene. Only one species of bacteria has been identified in laboratory microcosm studies that is capable of complete dechlorination of PCE or TCE to ethene in a pure culture. This bacteria is *Dehalococcoides ethenogenes*. Characterization of microbial communities at sites all over the world has revealed that *D. ethenogenes* is present in a wide variety of environments, but is not ubiquitous. For example, in a survey of dechlorinating sites in North America and Europe, it was observed that *D. ethenogenes* was detected at all 21 sites with complete dechlorination, and none of the 3 sites with DCE stall (Hendrickson et al., 2002).

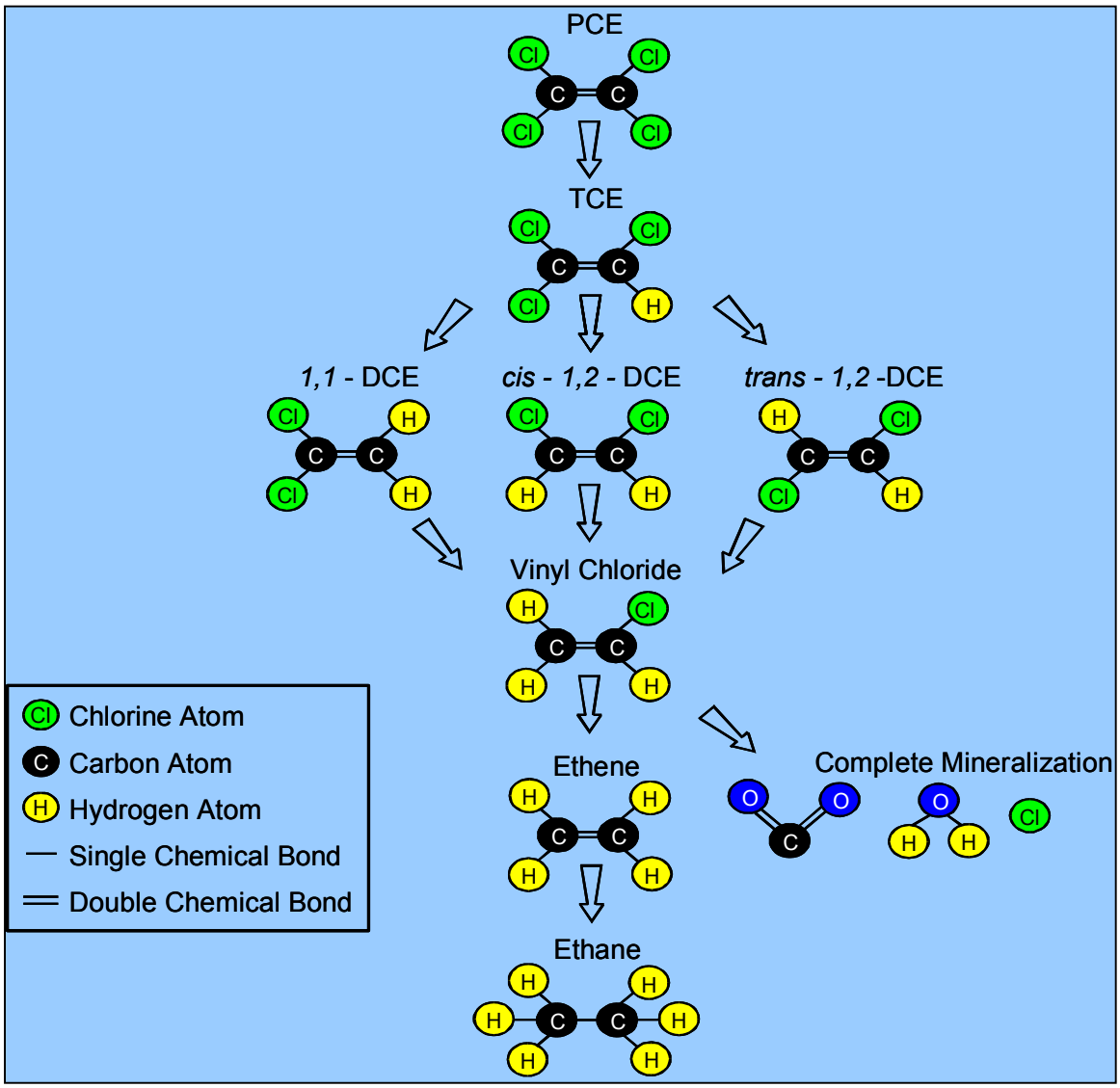

Figure 1. Reductive Dechlorination Pathway

There are a variety of potential strategies for solving the DCE Stall problem as follows:

- **No Action.** No action may be appropriate at sites with low parent compound concentrations. In this case, DCE stall may not prevent meeting cleanup standards because DCE is less toxic than PCE or TCE and therefore has a higher relative cleanup standard.

- **MNA.** The lower toxicity of DCE relative to PCE and TCE may bring natural attenuation pathways into play that would not have existed for the parent compound. Natural attenuation pathways for DCE include dilution, dispersion, cometabolic biodegradation, reductive dechlorination, and abiotic degradation.

- **MNA Wait**. A less conventional approach to MNA for DCE that might be applicable to low risk sites is to wait an extended period of time, while monitoring, to see if complete dechlorination eventually occurs. This will only be possible if a site is not electron donor limited and redox conditions are appropriate for the recruitment and growth of *D. ethenogenes.*

- **Biostimulation for Reductive Dechlorination**. Biostimulation is defined as the addition of amendments to stimulate the growth of microbes. Biostimulation may be appropriate for sites that appear to exhibit DCE stall under "natural" conditions and are electron donor-limited. Examples of electron donors used at chlorinated solvent sites include molasses, lactate, edible oils, acetate, ethanol, and other compounds.

- **Bioaugmentation for Reductive Dechlorination.** Bioaugmentation is defined as the addition of microbial cultures to groundwater to enhance biodegradation. Bio-augmentation may be a viable option at sites without the appropriate native microbes to complete DCE biodegradation. This application involves the addition of a *D. ethenogenes* containing microbial culture to site groundwater to facilitate complete dechlorination to ethene.

- **Biostimulation for Enhanced Biological Oxidation**. An alternative approach to dealing with biological limitations is to switch from anaerobic biodegradation processes to aerobic degradation processes. DCE and VC are both susceptible to aerobic biodegradation either as the primary substrate to support microbial growth or through aerobic cometabolism. Cometabolic biodegradation involves a reaction in which a microbe produces an enzyme to support its growth that also happens to degrade the target contaminant. The contaminant is not used as a source of energy, so the microbes require the presence of a primary substrate to support its growth and further enzyme production. The cometabolic degradation of DCE and/or VC can be facilitated by the injection of oxygen along with methane in the target treatment zone.

The best solution strategy for DCE stall will be dependent on site-specific issues such as the initial contaminant concentration, the type and amount of natural electron donors, the presence or absence of the appropriate microbial populations, and the distance to off-site receptors. Other regulatory and practical barriers may play a role in the selection of an acceptable strategy including the desired cleanup timeframe, the stakeholder's acceptance of innovative technologies, and the budget available for project implementation.

More information on DCE stall will be available in a Web-based Multimedia Training Tool to be launched in the spring of 2004. The tool will include a decision flow diagram to identify sites with DCE stall and to guide remedial project managers in the selection of a potential solution strategy for their site. The tool will be posted at www.ert2.org and its release will be announced in a T2 email update.

References

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North Wind, Inc. 2003. *DCE/VC Stall at Natural Attenuation Sites*. NAVFAC Remediation Innovative Technologies Seminar. Fall 2003.

Point of Contact

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Fast-Tracked Hangar Remediation Accomplished With Time To Spare

Coating of Eastern Portion of North Hangar Door with Cranes

The time-critical removal action (TCRA) successfully completed by the Southwest Division, Naval Facilities Engineering Command (Southwest, NAVFAC) for Hangar 1, located within the Former Naval Air Station (NAS) Moffett Field, California, is a prime example of a project that reduced immediate, physical threats to human health, public welfare, and the environment. The high degree of teamwork and cooperation among the Navy, Tetra Tech FW, Inc. (TtFW), the National Aeronautics and Space Administration Ames Research Center (NASA), the California Regional Water Quality Control Board (RWQCB), and the U.S. Environmental Protection Agency (EPA) resulted in limiting the migration of contaminants from Hangar 1 building materials, as well as completing the project work plan and health and safety plan, under the proposed budget and ahead of schedule.

Background

Hangar 1 is a Civil Engineering Landmark of Northern California, a contributing structure to the Shenandoah Plaza National Historic District. It is the largest hangar of its kind in the western United States with a footprint of approximately 350,000 square feet and a height of 200 feet. The hangar was constructed in 1932 to house the U.S.S. Macon, a giant airship that was a part of the Navy's lighter-than-air program. The hangar was built and painted with materials containing polychlorinated biphenyls (PCBs), lead, zinc, and asbestos. As the hangar's exterior continued to age, the

contaminated materials peeled and chipped away, migrating into the environment.

The contaminants were first discovered during routine cleanout and sampling activities in a sediment settling basin located within a stormwater retention pond in the northwestern corner of Moffett and almost a mile away from Hangar 1. Finding the PCB Aroclor 1268 in sludge from the basin prompted a series of investigations to identify the source of the relatively uncommon PCB. The result of intensive investigations was the discovery that PCBs, lead, and asbestos were eroding and leaching from the hangar's exterior walls and migrating into Moffett's stormwater drainage system. With rains and winds, the contaminants were traveling via Moffett's drainage system and eventually discharging into the stormwater retention pond.

To protect human health and potential ecological receptors within the stormwater retention pond, including Black-necked Stilts and Mallard Ducks, from the contaminants that were discovered, a cleanup action was necessary in 2003. Implementation of an interim TCRA was required prior to the upcoming rainy season in order to immediately limit any further migration of contaminants to the stormwater retention pond. By August 2003, the Navy awarded TtFW a fast-paced, five-month contract for completion of an interim TCRA.

West Side of Hangar During TCRA Activities

Technology Selection

Through collaboration during multi-agency meetings, interim alternatives ranging from limiting access to constructing a wastewater treatment system were considered until a final remedial option was selected for implementation. Face-to-face meetings among the entire team – the Navy, TtFW, NASA and all of the involved regulatory agencies – were the key to resolving comments on the proposed plan, rather than the traditional method of routing the document for comment. The selected TCRA consisted of applying a specialized coating to the corrugated exterior surfaces of the hangar. This action would stabilize the existing paint and surface materials for several years, pending a final remedial action.

To maintain the historical and cultural landmark's two-tone appearance, care was taken to use coating materials that would replicate the look of Hangar 1 and adhere to the existing substrate.

Additional activities associated with the selected remedial action included fence installation to control access to the hangar, preparation of the hangar surface by pressure washing, decontamination of the area surrounding Hangar 1 by pressure washing, and management of the waste streams created during preparation and cleaning.

Technology Implementation

Implementation of the selected time-critical

removal action of coating Hangar 1, which began in early September 2003, presented a number of unique challenges. The enormous size of the structure, which has a surface area of more than 18 acres and a height of more than 200 feet, required innovative methods to achieve complete coating. Initial plans called for access to the interior of the hangar, use of walkways atop the hangar, and installation of swing stages on the exterior of the hangar. The Navy, TtFW, and Techno Coatings, Inc., a specialty industrial painting subcontractor, decided to use three truck-mounted cranes with 300-foot reaches and seven elevated work platforms ranging from 68 feet to 135 feet to access the exterior of Hangar 1. From the cranes and elevated platforms, project personnel applied approximately 10,500 gallons of an asphalt emulsion coating, which was pumped from containers on the ground to nozzles at the end of specially designed 18-inch-wide application brooms. Careful coordination in scheduling the coating crews was critical. Multiple crews in crane-suspended platforms worked the high areas, and smaller elevated platforms followed behind to ensure personnel were not working above one another as they made their way around the hangar.

With the time-critical implementation of the project, health and safety procedures required constant modification to ensure the safety of workers and the general public while maintaining the rapid pace of the TCRA. Again, the Navy, NASA and TtFW worked together on regulatory compliance and health and safety issues. For example, the project team worked with NASA environmental and health and safety to quickly develop a plan for ambient air monitoring that was reviewed and approved by all parties to ensure the work on Hangar 1 would not affect air quality. The plan was then presented to workers nearby the hangar, informing them of the protective measures being adopted.

Through extensive air monitoring, including ambient air quality monitoring, personal air monitoring, and wind speed monitoring, the use of personal protective equipment, and site control procedures, site workers were properly protected from contaminants, and TtFW could ensure that no contaminants left the site. Project personnel were also protected from the numerous physical hazards associated with cranes and elevated platforms with extensive activity hazard analyses, which identify potential hazards and the recommended controls for each hazard.

The result of the efforts made to stabilize the exterior surfaces of Hangar 1 was the completion of the TCRA within an expedited three months, from contract award in August 2003 to completion of the core remedial activities by the end of October 2003; one day before the start of the rainy season.

Summary

Through teamwork and cooperation with multiple agencies and contractors, organization, and hard work, the migration of contaminants from Hangar 1 building materials was limited. Moreover, the effort was completed under the originally proposed budget and timeline. Contaminant releases with the potential to affect human health and Moffett's stormwater retention pond ecosystem during the 2003-2004 rainy season were minimized.

Points of Contact

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SOUTHERN DIVISION

NAS Whiting Field Partnering Team Collaborative Communication Tools

NAS Whiting Field, Milton, Florida

Naval Air Station (NAS) Whiting Field consisting of 3,842 acres was commissioned in 1943 and is used for initial training of naval aviators. NAS Whiting Field is 5-1/2 miles from Milton, Florida and employs approximately 2,700 military, civilian, and contractors.

NAS Whiting Field, a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) facility listed on the National Priorities List (NPL) in 1994, has 26 sites (Installation Restoration, Underground Storage Tank, Munitions Response Program) in the process of investigation and remedial action.

Project Summary

The timely review and preliminary approval of decision documents, Remedial Investigation (RI) reports, Feasibility Studies (FSs), Proposed Plans (PPs), and Records of Decision (RODs), are major factors in achieving site closure. The Partnering Team was already utilizing an environmental geographical information system (EGIS) for data storage and retrieval, map generation, and making decisions and Adobe Acrobat for reviews.

The Partnering Team chose to conduct a trial evaluation of an e-conferencing system with web-enabled voice conferencing (*MeetingPlace*) to allow team members to attend virtual meetings and make real time comments on document reviews. After the trial document review was successfully completed, the Partnering Team has continued to utilize the process whenever possible.

MeetingPlace provides a virtual meeting room where participants are able to attend a web conference using telecommunication voice conferencing and web enabled document sharing. This process utilizes the strengths of both mediums and provides users with the ability to collaborate on a discussion from multiple locations. Participants are notified and must respond by e-mail for the scheduled meeting, last minute guests can be added at the time of the meeting and the teleconference portion can be recorded if anyone is unable to attend and respond. Enabling the desktop sharing feature allows any participant to "take control" of the virtual desktop and move the cursor or add specific real time comments. Participants are able to share documents regardless of software used or the individuals' ownership of a particular application.

Facility:	Naval Air Station (NAS) Whiting Field, Milton, FL Established in 1943 NPL in 1994
EFD:	Southern Division
Description:	NAS Whiting Field Partnering Team Collaborative Communication Tools (Site 7 South AVGAS Tank Sludge Disposal Area)
Team Contact:	**SOUTHDIV RPM** (843) 820-5574 **NAS Whiting Field IR Coordinator** **USEPA RPM** **FDEP RPM** **CLEAN Contractor (TtNUS)** **RAC Contractor (CCI)**
Technology or Method:	Communication Tools (EGIS – IR Portal, *MeetingPlace*, and Acrobat)
Contaminant:	(Site 7 volatile organic compounds and semivolatile organic compounds)
Action Levels:	(Site 7 Residential)
Legal Driver:	National Priorities List (NPL)
Decision Document:	(Site 7 Completion Report)

Regulatory Involvement

The Whiting Field Partnering Team, with representatives from Naval Facilities Engineering Command, Southern Division (SOUTHDIV), NAS Whiting Field, United States Environmental Protection Agency (USEPA) Region 4, Florida Department of Environmental Protection (FDEP), Comprehensive Long-Term Environmental Action, Navy (CLEAN) and Remedial Action Contractor (RAC) contractors, was faced with having to schedule review and discussion meetings in a tight budget climate. Web conferencing allow this to happen within both budget and time restraints.

Challenges

Use of web conferencing at Site 7 illustrates how effective this process is as a data distribution and decision making tool.

Site 7 at Whiting Field is a former aviation gasoline (avgas) storage facility where soil contamination exists from the near surface to the water table, 130 feet below land surface. The Navy chose to utilize Environmental Multiple Award Contract (EMAC) contractors in a pay-for-performance contract, to remediate the site and to award the contract in a 3 to 4 month period and meet the current fiscal year budget.

The Partnering Team assisted with the technical review of the Statement of Work (SOW) so the regulatory agencies would be confident appropriate clean-up criteria were being proposed to the contractors. Web conferencing was utilized to allow SOW review and fine tuning of the technical requirements prior to submittal to the subcontractors. Even during time periods when face-to-face meetings were not possible web conferencing allowed the technical specifications to be developed for the EMAC contractors in a 2-month process.

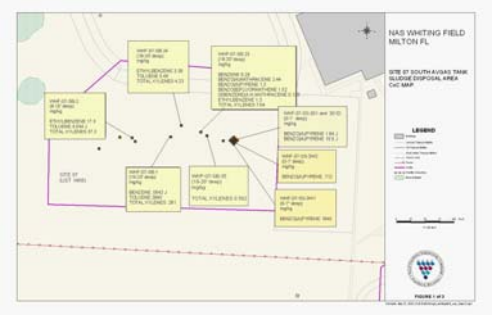
After the technical specification review, the Navy posted the SOW and associated data files on the SOUTHDIV file transfer protocol (FTP) site to allow the EMAC contractors to retrieve the files electronically, speeding up the process and reducing reproduction and mailing costs.

Once the EMAC contractors received the SOW, a web conference consisting of a virtual site tour was arranged. A 360-degree virtual tour of the site was developed using photographs, utility maps, and base maps and while maps showing investigation results with potential areas of contamination were prepared using Whiting Field EGIS. Because of the ease of attending the web conference, the Navy was able to have technical and contract individuals attend with no associated travel or extra costs.

Site 7 View to the Southeast

Site 7 View to the South

Site 7 Utilities Map



Site 7 CoC Map

The question and answer session during the web conference allowed all the contractors to ask questions and hear the follow up discussions in real time.

All contractors who participated in the web conference expressed multiple advantages such as ease of accessing the web conference, ability to have more of their people attend, cost avoidance, and savings in time associated with a walk over. One of the contractors was able to attend the phone conference via cell phone from an airport. The contractor used the hard versions of the SOW to follow along in the meeting.

The use of web conferencing provides the Navy the ability to receive comments on deliverables in the final stages of preparation and make corrections prior to official submittal to regulatory agencies. It provides an efficient way to convey real time information to contractors and receive instant feedback on the information.

Cost Avoidance Measures

Web conferencing allows a cost avoidance by reducing travel costs and associated meeting costs, and allows the individuals involved in the process to easily schedule a 1 or 2 hour web conference in weeks where time for travel does not exist. Web conferences are easy to schedule or revise and add or cancel participants as needed. They are low cost to set up and utilize at $0.18 per minute.

Project Successes

The Whiting Field partnering team has successfully used *MeetingPlace* to:

- Review feasibility studies for approval prior to submittal of Final documents;
- Review Draft PPs prior to a public meeting;
- Comment resolution on RIs, FSs & PPs to speed process;
- Review of Site 7 (South AVGAS Tank Sludge Disposal Area) Statement of Work (SOW) for SOUTHDIV; and conduct virtual tour of Site 7 at Whiting Field for a prebid meeting with the EMAC contractors;
- Daylong Partnering Team meeting.

Lessons Learned

As a result of using web conferencing tools, certain lessons have been learned to facilitate the process.

- Connection Dependent – DSL, Cable
- Have all documents and visual aids converted to the same format (pdf for example) to speed up the viewing process and while at a low enough resolution to allow prompt refresh time for those without broadband connections.
- Determine before a meeting if installed firewalls and security measures will prevent document viewing.


PROPOSED PLAN
Site 31, Sludge Beds and Disposal Areas
The Proposal
Site History

Proposed Plan Review

- Notify all attendees (especially first timers) to log in early enough to ensure appropriate viewing downloads and difficulties can be handled.
- Schedule enough time for the meeting.
- Develop an agenda and utilize it to reduce extraneous conversations.
- Supply hard copies or electronic versions of discussion materials in advance to allow for slow connections and technical glitches.
- Keep issues to be discussed at a minimum - use additional meetings instead of one long multiple issue meeting

The use of web conferencing has provided the Navy with a cost effective, real time means of conveying information to contractors and receiving input from regulatory agencies.

Technology Transfer (T2) News

Visit Our Web Site Address:

www.ert2.org

New Regulatory Guidance Document Released on Diffusion Bag Samplers

Naval Facilities Engineering Command (NAVFAC) is interested in fostering strong partnerships with the regulatory community and other project stakeholders. As part of these efforts, NAVFAC has established a relationship with the Interstate Technology Regulatory Council (ITRC) to promote the regulatory acceptance of innovative environmental technologies. ITRC has several Technical Teams that cover key environmental issues. Several representatives from NAVFAC have participated on the ITRC Diffusion Sampler Team.

This team has just released a new guidance document for regulators, technology users, and stakeholders to facilitate the use of polyethylene diffusion bag (PDB) sampling, particularly for long-term monitoring (LTM). The new document is titled the *Technical and Regulatory Guidance for Using Polyethylene Diffusion Bag Samplers to Monitor Volatile Organic Compounds in Groundwater* (February 2004).

The guide provides a quick screening methodology to determine a site's potential for the use of PDBs and a cost model to estimate potential cost avoidance relative to conventional LTM techniques. The report also discusses regulatory issues related to the acceptance of PDBs and notes that no regulatory issues were identified that would restrict their use under technically appropriate situations. This new guidance document can be downloaded from the ITRC's Web site at the following link: http://www.itrcweb.org/DSP-3.pdf.

Navy Policy Released on the Use of Background Chemical Levels

The Chief of Naval Operations (CNO) released a new *Navy Policy on the Use of Background Chemical Levels* in January 2004. The policy will assist Remedial Project Managers (RPMs) with issues such as obtaining no further action at a site, eliminating background chemicals from the contaminants of concern (COC), and identifying appropriate cleanup levels.

The policy requires a clear and concise understanding of the chemicals released from a site. Site characterization efforts should provide background data that can be used in a screening or baseline risk assessment to differentiate between the Navy's cleanup responsibilities and background sources. Any naturally occurring or anthropogenic chemicals that are present at levels below background should be eliminated from further consideration as chemicals of potential concern (COPCs). In some cases, there may be elevated risk from chemical levels below background levels. This risk is considered outside of the scope of the Navy's Environmental Restoration and Base Realignment and Closure (BRAC) Program (ERB), but should be communicated to stakeholders and documented in a qualitative discussion in the risk characterization for the site. Another important consideration is to ensure that cleanup action levels for the remediation site are risk-based and are not below established background levels.

RPMs interested in further information on how to establish defensible background levels to ensure cost effective cleanup at their sites can consult the new policy and the following related guidance documents. These documents can be downloaded from the NAVFAC ERB Web site at the following links:

DON Policy on the Use of Background Chemical Levels
http://enviro.nfesc.navy.mil/erb/erb_a/regs_and_policy/don_background-chem-levels01-04.pdf

Guidance for Environmental Background Analysis Volume I: Soil
http://enviro.nfesc.navy.mil/erb/erb_a/restoration/methodologies/bg_soil_guide.pdf

Guidance Document Guidance for Environmental Background Analysis Volume II: Sediment
http://enviro.nfesc.navy.mil/erb/erb_a/restoration/fcs_area/con_sed/ug-2054-sed-guide.pdf

Point of Contact

(805) 982-1656

Check out the New Guidance Document and Cost Estimating Tool!

Final Tri-Service "Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents" guidance document, and cost estimating tool are now available. Please call the point of contact phone number below to find out how to obtain a copy.

A Tri-Services Principles and Practices Manual "Final Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents" has been developed by the Navy, Air Force, and the Environmental Security Technology Certification Program (ESTCP). Enhanced in situ anaerobic bioremediation has emerged in recent years as a viable and cost-effective strategy for remediation of chlorinated solvents in groundwater. Advantages include complete mineralization of contaminants in situ with little impact on infrastructure, at a relatively low cost compared to more active, engineered remedial systems. However, the success of enhanced anaerobic bioremediation (EAB) has not been universally demonstrated, and relatively few sites have achieved some form of closure or regulatory remedy decision to date. However, it is clear from the "success" stories described in the literature that the technology holds great promise when properly applied. The manual has been developed to provide remedial project managers, and their contractors with a "road map" for appropriate and successful implementation of EAB technology at their sites, and to identify optimum approaches, while identifying "red flags" that may limit success.

Cost is often a primary factor in selecting EAB relative to other remedial technologies, as well as selecting from various ways to implement enhanced bioremediation. A cost estimating tool has also been developed to estimate and compare the life-cycle costs of alternative EAB systems. The cost estimating tool is intended to be used in conjunction with the Tri-Services Principles and Practices Manual when evaluating the cost benefits of alternative system designs. The tool is also intended to assist DOD project managers in comparing the cost of implementing EAB in various ways, and the results will be suitable for comparison to costs developed for other remedial technologies.

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(805) 982-4990

The NAVFAC ERB Web Site Has a New Look!

The revised Naval Facilities Engineering Command (NAVFAC) Environmental Restoration & (Base Realignment and Closure (BRAC) ERB Web site, shown above, is now available at http://enviro.nfesc.navy.mil/scripts/WebObjects.dll/erbweb. It's NAVFAC's "one stop shopping" location for information on environmental cleanup at Navy installations.

The site, which meets all Federal requirements and works within the NMCI environment, features updated information and archives, and can now be accessed more easily due to recent software upgrades that allow for user-friendly navigation. There are more than 300 pages of linked information, improving the overall efficiency of data searches. In addition, users can now easily bookmark or print any of the available pages.

The information found on this page and related linked pages provide detailed information on specific contaminants, toxicity, chemical constituents, and additional useful information. Navy guidance documents, information on innovative environmental technologies, and interactive training tools are also easily accessible.

In the future, the Navy plans to incorporate other NAVFAC Environmental Web sites focusing on Navy Installation Restoration (IR) site cleanup under this one site.

Point of Contact

For questions, comments, or additional information, please use the "Feedback" form available on the Web site or contact your Naval Facilities Engineering Service Center (NFESC) Technical Services Representative (TSR).